

WHAT IS CLAIMED IS:

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1. A prosthetic foot comprising:  
a foot plate element having a length approximately equal to the length of  
a human foot, the foot plate element comprising a resilient material capable of  
flexing along its length;  
at least one ankle plate element having a length substantially shorter than  
the foot plate element;  
an ankle block comprising a relatively soft, compressible material  
sandwiched between the ankle plate element and the foot plate element, the  
ankle block providing substantially the sole means of support and connection  
between the foot plate element and the ankle plate element; and  
at least one opening extending through the ankle block with a  
substantially transverse orientation relative to a forward walking motion;  
whereby the foot plate element and the ankle block flex in a cooperative  
manner to provide substantially smooth and continuous rollover transition from  
heel-strike to toe-off.
2. The prosthetic foot of Claim 1, wherein a first and second cylindrical  
opening extend through the ankle block, the first opening being positioned in a fore  
portion of the block and the second opening being positioned in a rear portion of the  
block, the first and second openings being oriented generally transverse to a forward  
walking motion.
3. The prosthetic foot of Claim 2, further comprising a third opening  
between the first and second openings.
4. The prosthetic foot of Claim 3, wherein the third opening is substantially  
oblong when the prosthetic foot is viewed from the side.
5. The prosthetic foot of Claim 3, further comprising three additional  
openings between the first and second openings.
6. The prosthetic foot of Claim 5, wherein the middle of said three  
additional openings has a substantially dual concave-outward shape when viewed from  
the side, and the other two of said three additional openings are substantially  
cylindrical.

7. The prosthetic foot of Claim 1, further comprising a stiffener positioned inside the opening.

8. The prosthetic foot of Claim 7, wherein the stiffener is hollow.

9. The prosthetic foot of Claim 7, wherein the stiffener is inflatable.

5 10. The prosthetic foot of Claim 7, wherein the stiffener is made of foam.

11. The prosthetic foot of Claim 1, wherein the at least one ankle plate element comprises an upper ankle plate and a lower ankle plate layered on top of one another.

10 12. The prosthetic foot of Claim 11, further comprising a strap surrounding the upper ankle plate and the lower ankle plate above a fore portion of the ankle block.

13. The prosthetic foot of Claim 1, further comprising a strap surrounding the at least one ankle plate element and the ankle block around a rear portion of the ankle block.

15 14. The prosthetic foot of Claim 1, further comprising a rotatable cam inserted into the opening.

15 15. The prosthetic foot of Claim 1, further comprising a wedge cut-out in a rear portion of the ankle plate.

16. The prosthetic foot of Claim 15, further comprising a wedge piece inserted into the wedge cut-out.

20 17. A prosthetic foot, comprising:

a lower foot plate;

an upper ankle plate disposed above and generally over said lower foot plate and being spaced therefrom; and

25 a plurality of inflatable bladders disposed between the upper ankle plate and the lower foot plate and separating the upper plate from the lower plate, said bladders providing substantially the sole means of support between the foot plate and the ankle plate and wherein the foot plate and the bladders flex in a cooperative manner to provide substantially smooth and continuous rollover transition from heel-strike to toe-off.

30 18. The prosthetic foot of Claim 17, wherein the plurality of inflatable bladders includes at least one heel bladder and at least one toe bladder.

19. The prosthetic foot of Claim 18, wherein the at least one toe bladder includes two toe bladders in fluid communication.

20. The prosthetic foot of Claim 17, further comprising separate valves for independently controlling fluid pressure in each of the bladders.

5 21. The prosthetic foot of Claim 17, further comprising a strap surrounding the lower foot plate and the upper ankle pate, and at least one of the inflatable bladders.

22. A prosthetic foot for connecting to a pylon of an amputee, comprising  
a foot plate element having a length approximately equal to the length of  
a human foot, the foot plate element comprising a resilient material capable of  
10 flexing along its length;

an ankle plate element having a length substantially shorter than the foot  
plate element;

15 at least one inflatable bladder between the ankle plate element and the  
foot plate element, the at least one inflatable bladder providing substantially the  
sole means of support and connection between the foot plate element and the  
ankle plate element;

a fluid pump that generates pressure based on the movement of the  
amputee onto the pylon;

20 a fluid pathway for directing fluid into the at least one inflatable bladder.

23. The prosthetic foot of Claim 22, wherein the fluid pump is a syringe including a plunger and a cylinder.

24. The prosthetic foot of Claim 23, further comprising a lower pylon and an upper pylon which are telescopingly engaged.

25 25. The prosthetic foot of Claim 24, wherein the plunger is attached to the upper pylon and the cylinder is attached to the lower pylon, and the plunger moves into and out of the cylinder as the upper pylon moves into and out of the lower pylon.

26. The prosthetic foot of Claim 22, wherein the fluid pathway includes a valve manifold for directing fluid into multiple inflatable bladders.

30 27. The prosthetic foot of Claim 26, wherein the valve manifold is electronically controlled to regulate the amount of fluid directed into each inflatable bladder.

28. The prosthetic foot of Claim 22, further comprising a fluid accumulator connected between the fluid pump and the at least one inflatable bladder.

29. A pump system for a prosthetic foot, comprising:

at least one inflatable bladder;

5 a syringe including a plunger and a cylinder;

a fluid pathway connecting the syringe to the at least one inflatable bladder; and

10 a first pylon and a second pylon telescopingly engaged, wherein the plunger is connected to the first pylon and the cylinder is connected to the second pylon, such that relative movement between the first and second pylon moves the plunger in and out of the cylinder to generate pressure within the at least one inflatable bladder.

30. The pump system of Claim 29, wherein the syringe is externally connected to the pylons.

15 31. The pump system of Claim 29, wherein the fluid pathway includes an accumulator.

32. The pump system of Claim 29, wherein the of least one inflatable bladder includes a heel bladder and at least one toe bladder.

20 33. The pump system of Claim 29, wherein the fluid pathway includes a valve manifold for separately directing fluid into the heel bladder and the at least one toe bladder.

34. The pump system of Claim 29, wherein the at least one inflatable bladder is provided between a foot plate and an ankle plate.

25 35. The pump system of Claim 29, wherein the syringe further includes an intake port.

36. A prosthetic foot, comprising:

an inner pylon and an outer pylon that are telescopingly engaged, and further comprising a compressible member positioned in a chamber defined between the inner and outer pylons, wherein the inner pylon moves relative to the outer pylon upon the application and release of a compressive force onto the prosthetic foot;

a fluid line in communication with the chamber; and

at least one inflatable bladder in communication with the fluid line, wherein fluid pressure is generated in the at least one inflatable bladder based on the relative movement between the inner and outer pylons.

37. The prosthetic foot of Claim 36, wherein said at least one inflatable bladder is disposed between an upper ankle plate and a lower ankle plate.

38. The prosthetic foot of Claim 36, further comprising a valve connected to the inner pylon for controlling fluid pressure in the chamber.

39. The prosthetic foot of Claim 36, further comprising a reservoir between the chamber and the fluid line, the reservoir and chamber being separated by a valve.

40. The prosthetic foot of Claim 36, further comprising a valve in the fluid line for controlling fluid flow into the at least one inflatable bladder.

41. The pump system of Claim 36, wherein the compressible member is a spring.

42. The pump system of Claim 36, wherein the compressible member is a compressible fluid.

43. A prosthetic foot comprising:

a foot plate element comprising a resilient material capable of flexing along its length;

at least one ankle plate element;

an ankle block comprising a relatively soft, compressible material sandwiched between the ankle plate element and the foot plate element, the ankle block providing substantially the sole means of support and connection between the foot plate element and the ankle plate element;

at least one opening extending through the ankle block with a substantially transverse orientation relative to a forward walking motion; and

at least one cam inserted into the at least one opening, said cam being rotatable to locally adjust the stiffness of the ankle block.

44. The prosthetic foot of Claim 43, wherein the at least one opening includes two openings oriented parallel to one another, one of said openings being in a fore portion of the ankle block, the other of said openings being in a rear portion of the ankle block.

45. The prosthetic foot of Claim 44, wherein the at least one cam includes a pair of cams, each cam inserted into one of said openings.

46. The prosthetic foot of Claim 45, wherein one of said cams is oriented such that its cross-section is aligned substantially transversely relative to a forward walking motion, while the other of said cams is oriented such that its cross-section is aligned substantially parallel to a forward walking motion.

47. A prosthetic foot comprising:

a foot plate element comprising a resilient material capable of flexing along its length;

at least one ankle plate element;

an ankle block comprising a relatively soft, compressible material sandwiched between the ankle plate element and the foot plate element, the ankle block providing substantially the sole means of support and connection between the foot plate element and the ankle plate element;

a first and second chamber extending through the ankle block, the first chamber being positioned in a fore portion of the block and the second chamber being positioned in a rear portion of the block, the first and second chambers being oriented generally transverse to a forward walking motion; and

first and second stiffeners positioned in the first and second chambers, respectively, said first and second stiffeners being moveable within each of said chambers.

48. The prosthetic foot of Claim 47, wherein each of said stiffeners is connected by arms to an actuator located between the first and second chambers.

49. The prosthetic foot of Claim 48, wherein the arms are integrally formed and the stiffeners are separated by a constant distance.

50. The prosthetic foot of Claim 48, wherein the actuator is a motor that adjustably positions each of the stiffeners within said chambers.

51. The prosthetic foot of Claim 48, wherein the actuator is a knob.

52. The prosthetic foot of Claim 51, wherein when the knob is turned in one direction the stiffeners move closer together, and when the knob is turned in the other direction the stiffeners move farther apart.

53. A prosthetic foot comprising:

a foot plate element comprising a resilient material capable of flexing along its length;

at least one ankle plate element; and

5 an ankle block comprising a relatively soft, compressible material sandwiched between the ankle plate element and the foot plate element, the ankle block providing substantially the sole means of support and connection between the foot plate element and the ankle plate element, and wherein the ankle block includes a wedge cut-out in a rear portion of the ankle block.

10 54. The prosthetic foot of Claim 47, further comprising a wedge piece inserted into the wedge cut-out.

55. The prosthetic foot of Claim 54, wherein the wedge piece has a convex shape.

56. The prosthetic foot of Claim 54, wherein the wedge piece has a stiffness that is greater than that of the ankle block.

15 57. The prosthetic foot of Claim 54, wherein the wedge piece has a stiffness that is less than that of the ankle block.

58. A prosthetic foot comprising:

a foot plate element comprising a resilient material capable of flexing along its length;

20 at least one ankle plate element;

an ankle support member sandwiched between the ankle plate element and the foot plate element, the ankle block providing substantially the sole means of support and connection between the foot plate element and the ankle plate element; and

25 a strap connecting the ankle plate element to the foot plate element, said strap positioned behind said ankle block relative to a forward walking motion and capable of adjusting the relative flexing properties between said ankle plate element and said foot plate element.

30 59. The prosthetic foot of Claim 58, wherein the length of said strap between said ankle plate element and said foot plate element is adjustable.

60. The prosthetic foot of Claim 58, further comprising an insert placed within the strap.

61. The prosthetic foot of Claim 60, wherein the insert is C-shaped.

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